Research Project: SP009B4K
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RESEARCH SUMMARY

EXAMINE IMPACT TO HIGHWAYS/STRUCTURES – VEHICLES EQUIPPED WITH LIFT AXLES

Problem

As the number of heavy trucks on all roads increase, so does the chance for potential damage to Maryland's highway system. There has been increasing interest in lift-axle equipped trucks due to their effect on Maryland highway and bridge structures. Lift-axle equipped trucks are those equipped with additional axles that can be raised or deployed to assist in distributing the weight of the load. These truck configurations are becoming more popular as business continues to grow and cargo sizes increase. However, as technology continues to develop, so do truck configurations. Trucks with two, three and even four lift axles are traveling on highways systems, but there are concerns about the potential for damage due to heavily loaded multi-axle vehicles.

Objective

The objectives of this research project were to:

- Locate, assemble and document other states' requirements and concerns for lift-axle equipped vehicles;
- Identify what other states are doing to examine the effects of lift axles and what methods are being employed to solve them;
- Identify current or on-going research that may be underway nationally regarding this issue;
- Coordinate with enforcement to produce data derived from enforcement initiatives/spot checks;
- Organize, evaluate, and document the information acquired and produce a final report assessing the project; and
- If it is determined that this is a significant problem; examine and identify countermeasures which could include seeking legislation instituting mandated down-force pressure requirements for multiple lift axle equipped vehicles operating in Maryland.

Description

A survey was sent to all state Departments of Transportation (DOTs) to gather more specific information about policies and practices in each state. One Canadian province also responded to the survey and two other Canadian provinces sent information.

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RESEARCH SUMMARY

Description (continued)

Aside from surveys, the Maryland State Highway Administration (SHA) provided truck data from a virtual weigh station (VWS) on MD 32 in Howard Country. After completing proper statistical analysis, theoretical evaluations were completed to measure potential damage to both bridge structures and pavement. A safety initiative was another component of this project. The research team coordinated with the Maryland State Police (MSP) to develop an inventory from roving crews across the State for one month (2/15/2011–3/20/2011) on the variety in lift-axle equipped trucks. After application of the statistical analysis to the collected data, recommendations and conclusions were proposed.

Results

Overall, in each analysis approach the lift axle does have an effect on the behavior of both the bridge structure and the highway pavement. The research found that in almost all of the failure modes, when the lift axle is raised, the weight carried by the lift axle is redistributed to the rear tandem axles. When loading is redistributed to the tandem axles, this essentially puts higher stresses on the structure and thus creates higher moments and shears at critical points along the structure.

Moreover, when trucks are running at the maximum gross vehicle weights, the position of the lift axle becomes very crucial in analysis. Whether the lift axle is raised or deployed at heavy loads has a major impact on potential damage to highways and structures. If trucks are running at maximum weights and the lift axle is not deployed, in accordance with Maryland regulations, this creates not only non-compliance issues, but also distributes a substantial amount of weight to the rear tandems. Even if the truck is not overweight, the redistribution of weight puts more stress on the rear tandem axles which is more harmful to the structure. For example, some lift axles are positioned in front of the rear tandems, and others are positioned behind the rear tandems. Making truck companies accountable for violations and increasing the penalties for those who violate lift axle usage regulations, can help reduce damage to highway infrastructure assets.

Report Information

Dr. Chung C. Fu (Project P.I.), Director and Research Professor, The Bridge Engineering Software & Technology (BEST) Center, Dept. of Civil and Environmental Engineering, University of Maryland, Phone: 301-405-2011, Email: ccfu@umd.edu